



## GaAs MMIC NON-REFLECTIVE DIFFERENTIAL SPDT SWITCH, DC - 4 GHz

### Typical Applications

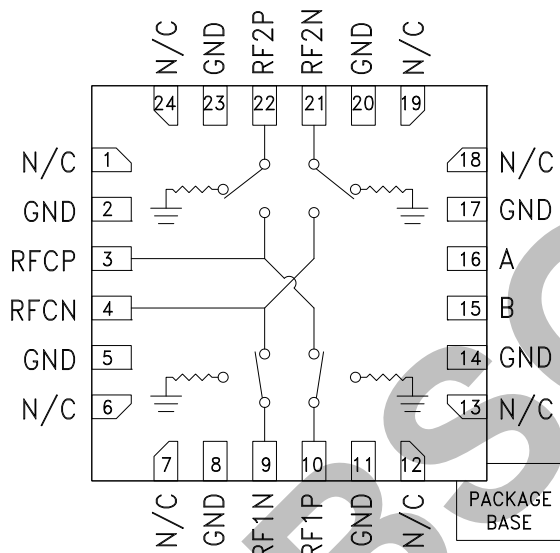
The HMC922LP4E is ideal for:

- Test & Measurement Equipment
- Antenna Diversity & Selector Selection
- Broadband Switch Matrices
- Military, EW & ECM
- SATCOM & Space

### Features

- Differential SPDT Functionality
- Low Insertion Loss: 0.8 dB
- High IP3: +50 dBm
- High Input P1dB: +35 dBm
- Positive Control: 0/+3V to 0/+5V
- 24 Lead 4x4 mm QFN Package: 16 mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC922LP4E is a DC to 4 GHz high isolation GaAs MMIC non-reflective Differential SPDT switch in a low cost leadless surface mount package. The switch is ideal for antenna diversity & selector selection, broadband switch matrices, test & measurement equipment, military and space applications yielding up to 60 dB isolation, low 0.8 dB insertion loss and +50 dBm input IP3. Power handling is excellent with the switch offering a P1dB compression point of +35 dBm. On-chip circuitry allows two positive voltage controls of 0/+3V to 0/+5V at very low DC currents.

### Electrical Specifications,

$T_A = +25^\circ\text{C}$ ,  $V_{ctl} = 0/+3\text{Vdc}$  (Unless Otherwise Stated), 50 Ohm System

Parameter	Frequency	Min.	Typ.	Max.	Units
Insertion Loss	DC - 2.0 GHz		0.8	1.2	dB
	2.0 - 4.0 GHz		1.2	1.5	dB
Isolation:	State 1: RFCN-RF2P, RFCN-RF2N, RFCP-RF2N, RFCP-RF2P	DC - 2.0 GHz	45	60	dB
	State 2: RFCN-RF1P, RFCN-RF1N, RFCP-RF1N, RFCP-RF1P	2.0 - 4.0 GHz	40	45	dB
Isolation	State 1: RFCN-RF1P, RFCP-RF1N	DC - 2.0 GHz	30	40	dB
	State 2: RFCN-RF2P, RFCP-RF2N	2.0 - 4.0 GHz	20	30	dB
Return Loss (On State, Any Port)	DC - 2.0 GHz		20		dB
	2.0 - 4.0 GHz		15		dB
Input Power for 1 dB Compression	0.5 - 4.0 GHz	$V_{ctl} = 0/+3\text{V}$	30		dBm
		$V_{ctl} = 0/+5\text{V}$	35		dBm
Input Power for 0.1 dB Compression	0.5 - 4.0 GHz	$V_{ctl} = 0/+3\text{V}$	27		dBm
		$V_{ctl} = 0/+5\text{V}$	32		dBm
Input Third Order Intercept (Two-Tone Input Power= +7 dBm Each Tone)	0.5 - 4.0 GHz	$V_{ctl} = 0/+3\text{V}$	50		dBm
		$V_{ctl} = 0/+5\text{V}$	50		dBm
Switching Characteristics	DC - 4.0 GHz	tRISE / tFALL (10/90% RF)	15		ns
		tON / tOFF (50% CTL to 10/90% RF)	40		ns

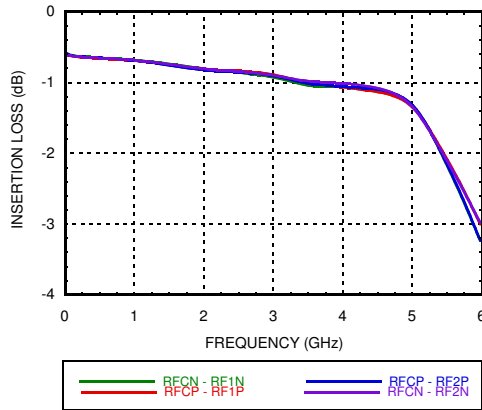
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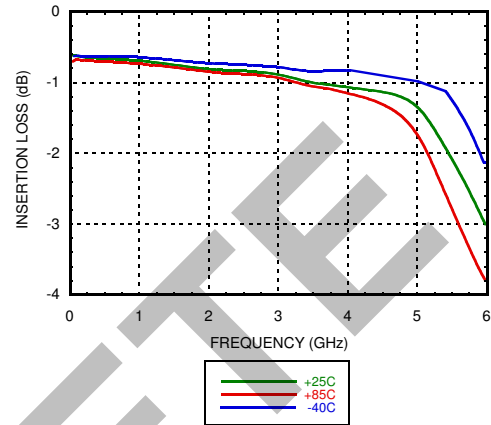


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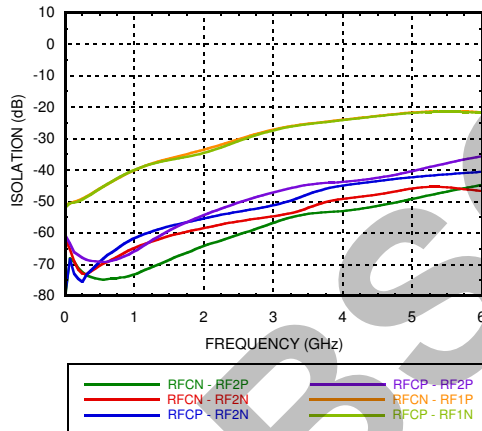
**Insertion Loss**



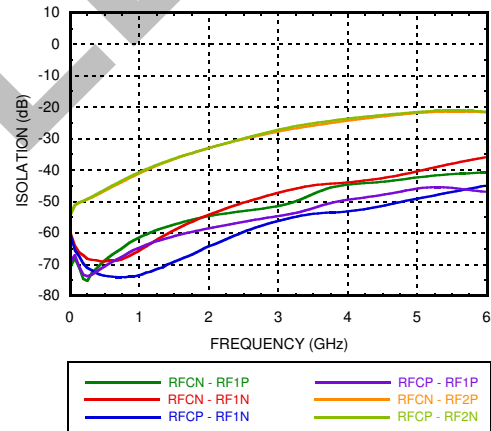
**Insertion Loss vs. Temperature**



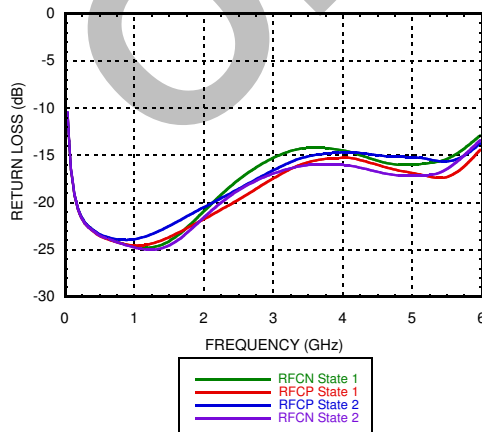
**Isolation State 1**



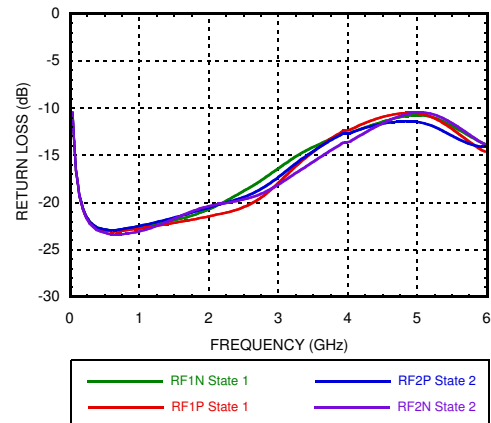
**Isolation State 2**



**Return Loss RFC**



**Return Loss RF1, 2**

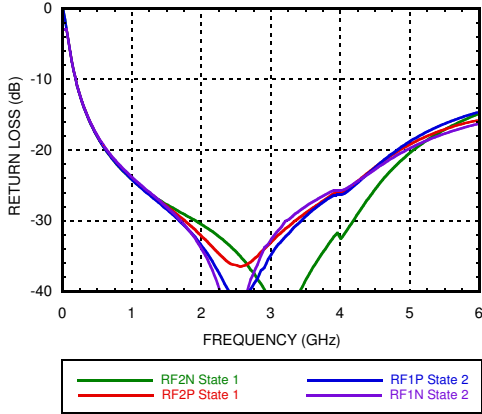




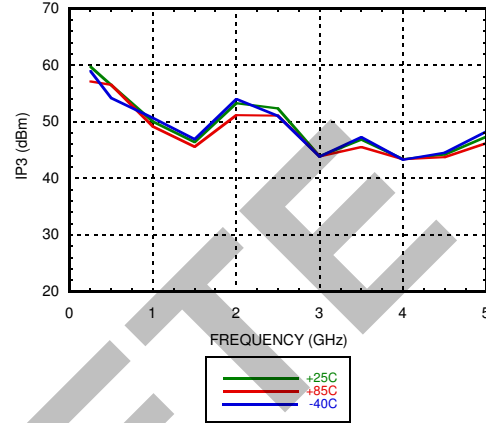
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SWITCHES - SMT

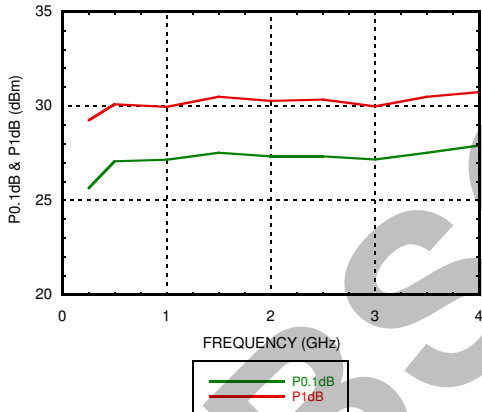
**Off State Return Loss**



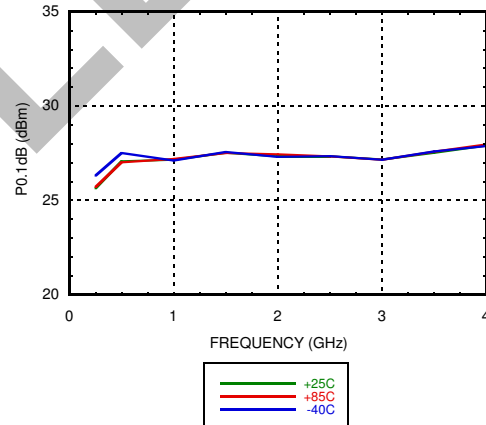
**Input IP3\* @ 3V**



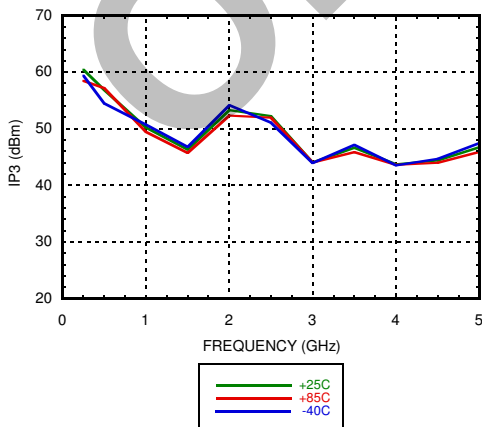
**Input 0.1dB & 1 dB Compression Point @ 3V**



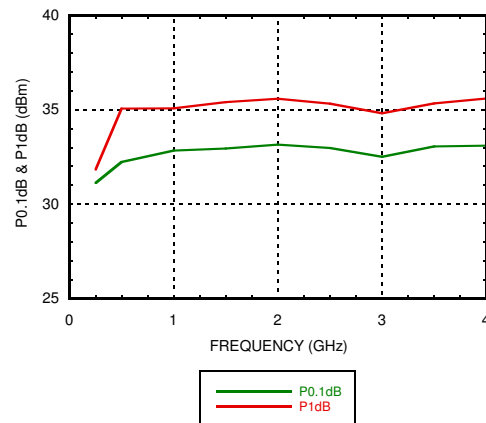
**Input 0.1dB Compression Point vs. Temperature @ 3V**



**Input IP3 \* @ 5V**



**Input 0.1 dB & 1 dB Compression Point @ 5V**



\* Two-tone input power = +7 dBm each tone, 1 MHz spacing.

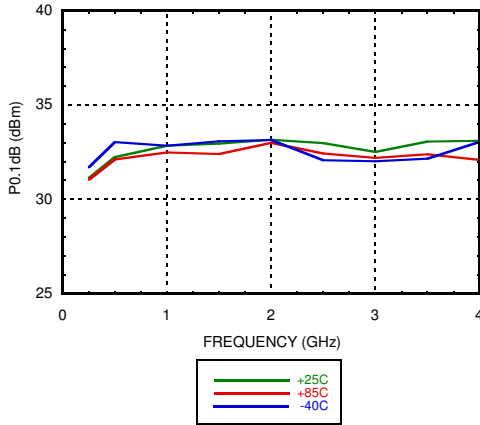
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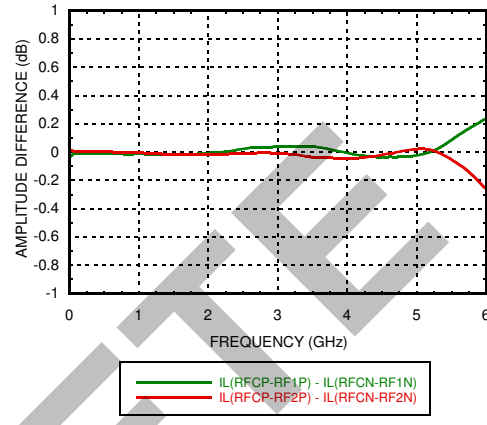


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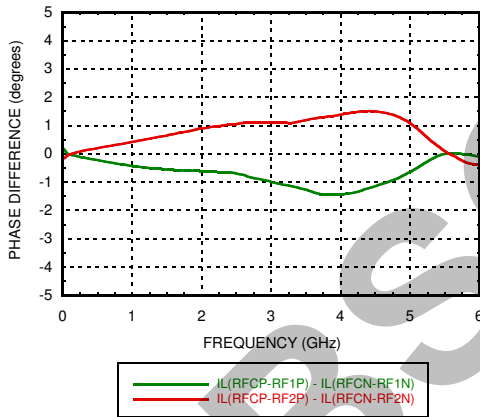
**Input 0.1 dB Compression  
Point vs. Temperature @ 5V**



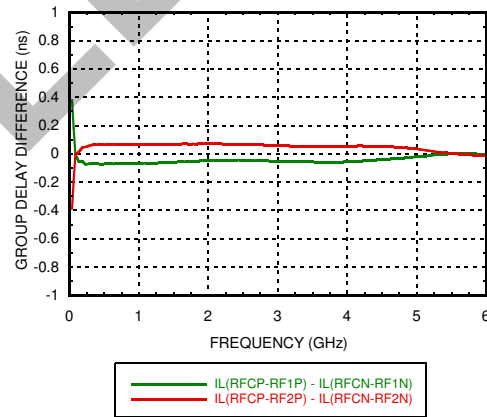
**Insertion Loss Amplitude Mismatch**



**Insertion Loss Phase Mismatch**



**Group Delay Mismatch**



**Absolute Maximum Ratings**

Control Voltage (A, B)	-0.5V to 8V DC
RF Input Power	32 / 34 dBm Through Path 3V/5V Termination Path 3V/5V
Channel Temperature	150 °C
Thermal Resistance (channel to package ground paddle)	30 °C/W Through Path 79 °C/W Termination Path
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class 1A

**Control Voltages**

State	Bias Condition
Low	0 to +0.5 Vdc @ < 1 µA Typ.
High	+3.0 to +5.5 Vdc @ 20 µA Typ.

**Truth Table**

	Control Input		Signal Path State	
	A	B	RFCP to:	RFNC to:
State 1	High	Low	RF1P	RF1N
State 2	Low	High	RF2P	RF2N

Do not operate continuously at RF power input greater than 1 dB compression and do not hot switch power levels greater than +27 dBm for control = 0/+3 Vdc, or +30 dBm for control = 0/+5 Vdc.



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

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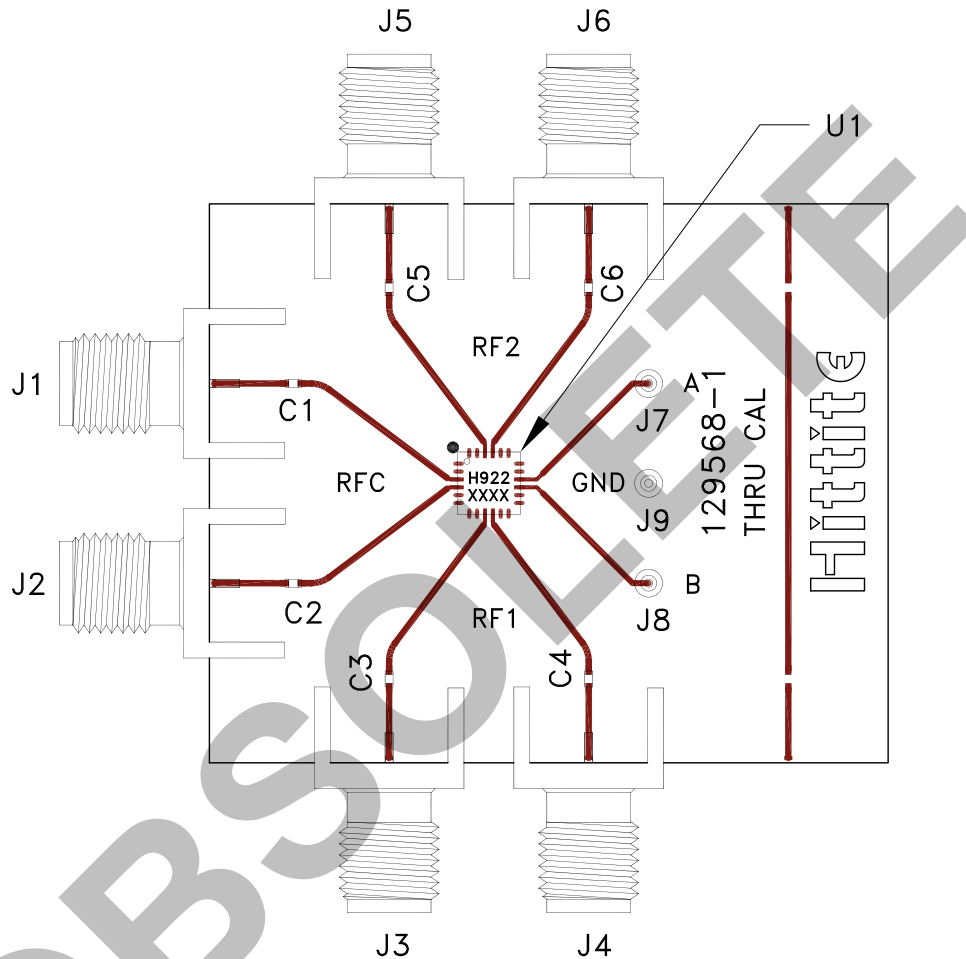
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**Evaluation PCB**



**List of Materials for Evaluation PCB 129570 [1]**

Item	Description
J1 - J6	PCB Mount SMA RF Connector
J7 - J9	DC Pin
C1 - C6	330 pF Capacitor, 0402 Pkg.
U1	HMC922LP4E SPDT Switch
PCB [2]	129568 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 Ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown above. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown above is available from Hittite upon request.